



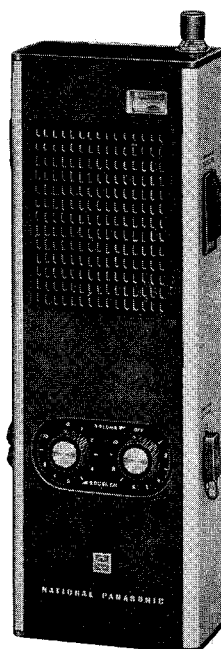
# NATIONAL PANASONIC

## Service Manual

ORDER NO. RD-498

### 2-CHANNEL CITIZEN BAND TRANSCEIVER

MODEL **RJ-20E**



#### SPECIFICATIONS

Frequency :	27 Mc/s Citizen Band	Diodes :	OA90 Detector & AGC
Intermediate Frequency :	455 kc/s		OA90 AF Detector
Transistors :	2SC478 Transmitter Oscillator	Sensitivity :	1 $\mu$ V for 50mW Output
	2SC456 Transmitter Last Stage Amplifier		2 $\mu$ V for S/N=10 dB Quieting
	2SA341 Receiver RF Amplifier	Power Output :	Receiver... 500mW Maximum
	2SA341 Receiver Converter		300mW Undistorted
	2SA101 1st IF Amplifier		Antenna...500mW
	2SA101 2nd IF Amplifier	Batteries :	12V (Eight "AA" size penlight batteries)
	2SB173 1st AF Amplifier		(NATIONAL UM-3 or equivalent)
	2SB175 2nd AF Amplifier	Speaker & Microphone :	6cm (2 $\frac{1}{4}$ ") PM Dynamic Speaker, 8 $\Omega$
	2SB178 } Power & Modulator Amplifier	Cabinet Dimensions :	85 (Wide) $\times$ 254 (High) $\times$ 43 (Deep) mm
	2SB178 } (push-pull)		(3 $\frac{1}{8}$ " $\times$ 10" $\times$ 1 $\frac{1}{16}$ ")
	2SC183 Receiver Squelch	Weight :	950g. (2 lb. 1 $\frac{1}{2}$ oz.) with Batteries

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## MODEL RJ-20E

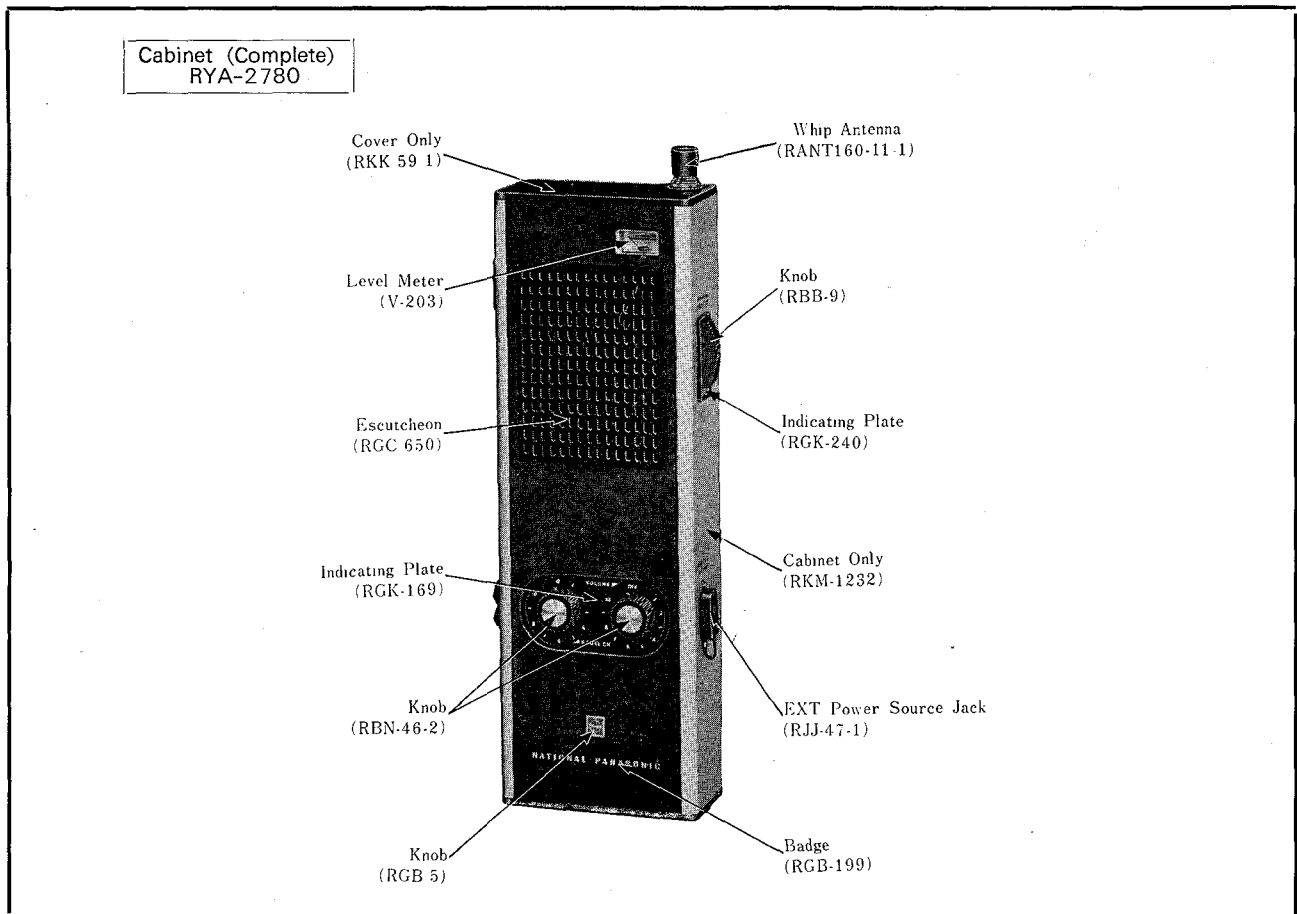


Fig. 1 Cabinet & Appearance - Parts Identification.

## DISASSEMBLY INSTRUCTIONS

### To Remove Chassis (Refer to Fig. 2, 3 & 4)

1. Remove two (2) control knobs from cabinet front.
2. Hold transceiver in a horizontal position with back side facing up, PUSH the button on the back of the unit and the battery case will eject itself. Do not allow the battery case to fall.

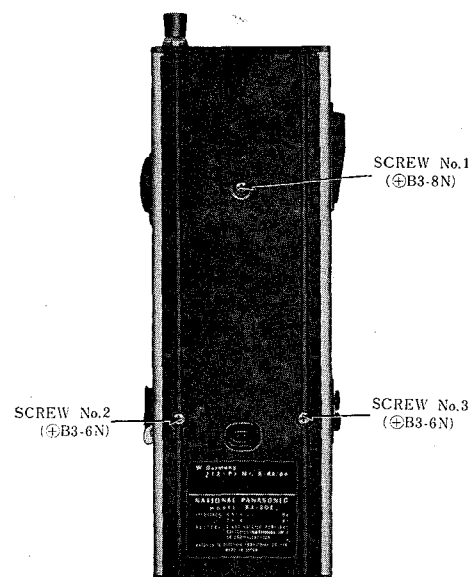


Fig. 2

MODEL RJ-20E

3. Remove three (3) cabinet back cover mounting screws, Nos. 1~3, as illustrated in Fig. 2.
4. Remove red whip antenna mounting screw as illustrated in Fig. 3.
5. Remove five (5) red chassis mounting screws, Nos. 1~5, as illustrated in Fig. 4.
6. To remove chassis completely, unsolder leadwires to level meter, earphone, microphone, EXT power source jack and speaker terminals.
7. To reassemble, reverse the above procedure.

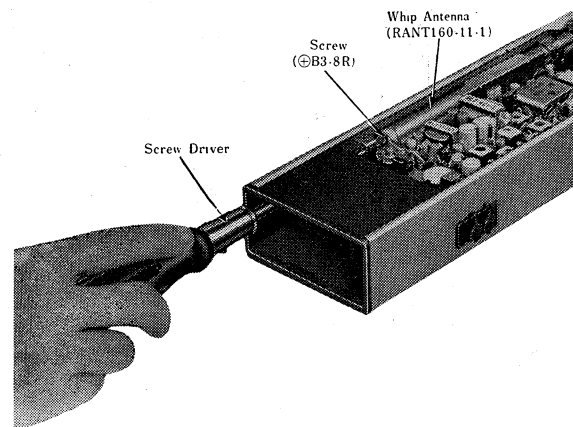


Fig. 3

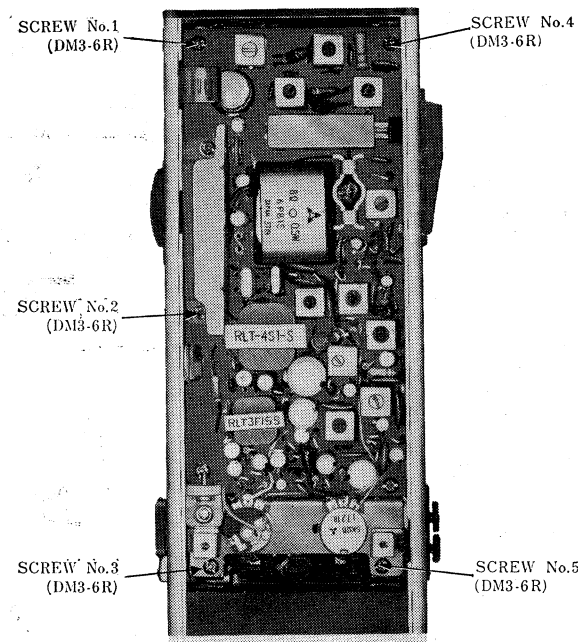


Fig. 4

ALIGNMENT INSTRUCTIONS

Equipment Required

1. Signal Generator
2. VTVM with RF Probe
3. Audio Output Indicator (Voltmeter)
4. DC Milliammeter or Tester
5. RF VTVM

Note:

Lead connections in set-up should be kept as short as possible

LEVEL METER ALIGNMENT

PROCEDURE

1. Set power source voltage to 12V (DC).
2. Do not apply signal.
3. Adjust 50K $\Omega$  potentiometer (R<sub>24</sub>) so that the pointer of the Level Meter stays as shown in Fig. 5.

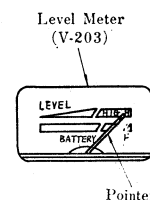


Fig. 5

TRANSMITTER ALIGNMENT

(See Figure 8)

PROCEDURE

- Volume Control.....Maximum.
- Squelch Control.....Minimum.
- Push To Talk Switch.....Transmitter (Pressed Position)
- Whip Antenna.....Remove from Cabinet.
- Channel Selector Switch.....A or B
- Power Source Voltage.....12V (DC).
- Remove shorting link from its terminals and mount it after completing alignment.

Note:

- Do not adjust cores of L<sub>3</sub> and L<sub>4</sub>.

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STEP	ALIGNMENT	ADJUST	ADJUSTMENT
1	OSC	L <sub>1</sub> (OSC COIL)	Adjust L <sub>1</sub> for maximum indication on VTVM and back down 1/2 turn.
2	LAST STAGE	L <sub>2</sub> (LAST STAGE COIL)	Adjust L <sub>2</sub> for minimum indication on milliammeter.
3	ANT	L <sub>5</sub> (LOADING COIL)	Adjust L <sub>5</sub> for maximum indication on milliammeter.
4	CURRENT	R <sub>8</sub> (CURRENT CONTROL)	Adjust R <sub>8</sub> for 100mA indication on milliammeter.
5	Repeat Step 1	L <sub>1</sub>	As above
6	ANT	L <sub>5</sub>	Adjust L <sub>5</sub> for maximum indication on VTVM.
7	LAST STAGE	L <sub>2</sub>	Adjust L <sub>2</sub> for maximum indication on VTVM.
8	Repeat Step 1	L <sub>1</sub>	As above
9	Repeat Step 1 through Step 4	L <sub>1</sub> , L <sub>2</sub> , L <sub>5</sub> , R <sub>8</sub>	As above, and adjust for 100mA milliammeter reading.

RECEIVER ALIGNMENT

(See Figure 9)

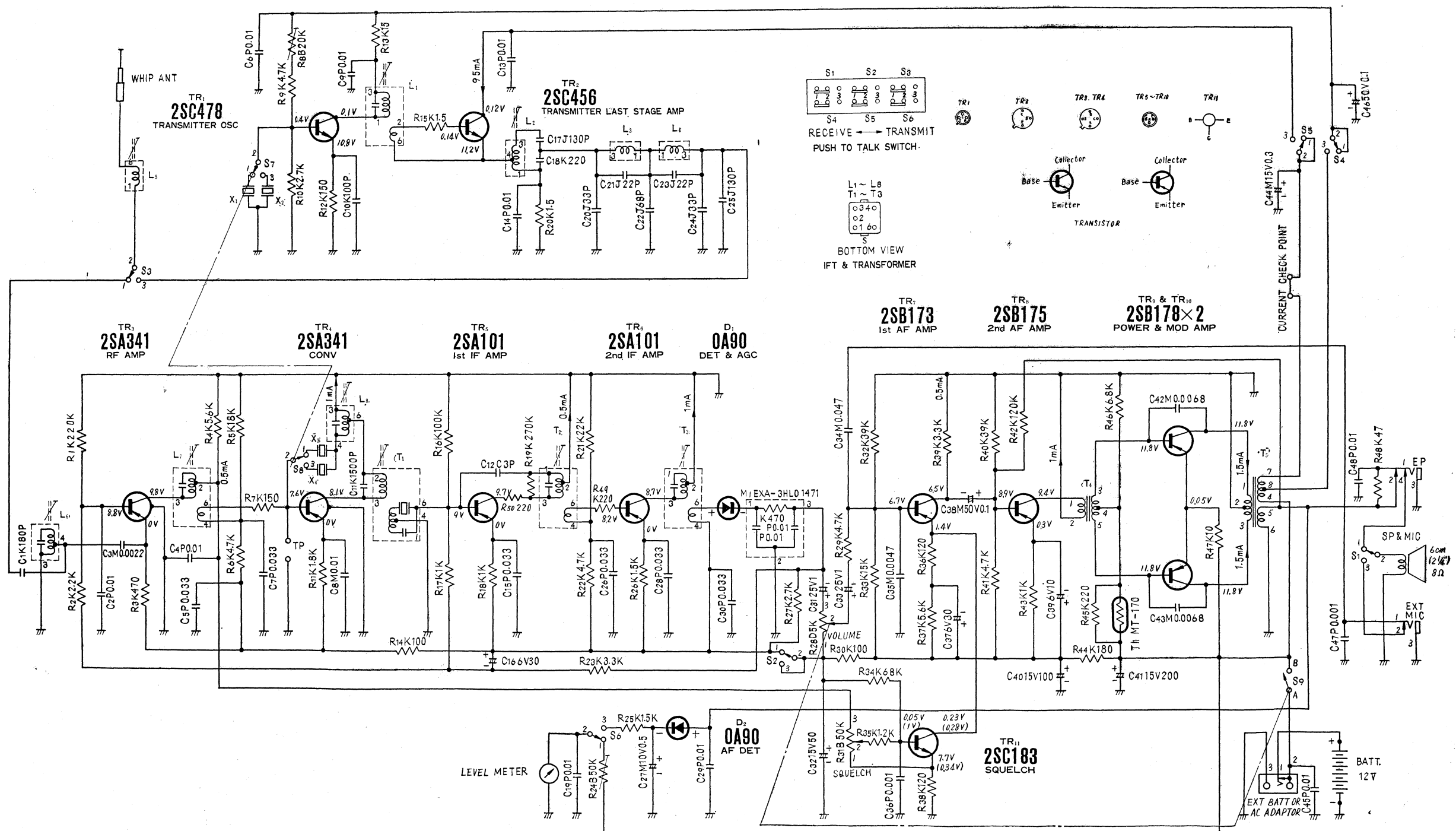
PROCEDURE

- Volume Control.....Maximum.
- Squelch Control.....Minimum.
- Push To Talk Switch.....Receiver (Unpressed Position).
- Channel Selector Switch.....A or B
- Power Source Voltage.....12V (DC).
- Whip Antenna.....Remove from Cabinet.

STEP	ALIGNMENT	SIGNAL GENERATOR	ADJUST	ADJUSTMENT
1	IF	27 Mc/s Band 1000 c/s Mod.	T <sub>1</sub> , T <sub>2</sub> , T <sub>3</sub> (IFT)	T <sub>1</sub> , T <sub>2</sub> and T <sub>3</sub> for maximum audio output.
2	Repeat Step 1	"	"	As above.
3	ANT	"	L <sub>6</sub> (ANT COIL)	Adjust L <sub>6</sub> for maximum audio output.
4	DET	"	L <sub>7</sub> (DET COIL)	Adjust L <sub>7</sub> for maximum audio output.
5	OSC	"	L <sub>8</sub> (OSC COIL)	Adjust L <sub>8</sub> for abrupt indication on audio output, then back down the core (L <sub>8</sub> ) 1 turn.
6	Repeat Step 3 through step 5.	"	L <sub>6</sub> , L <sub>7</sub> , L <sub>8</sub>	As above

Notes:

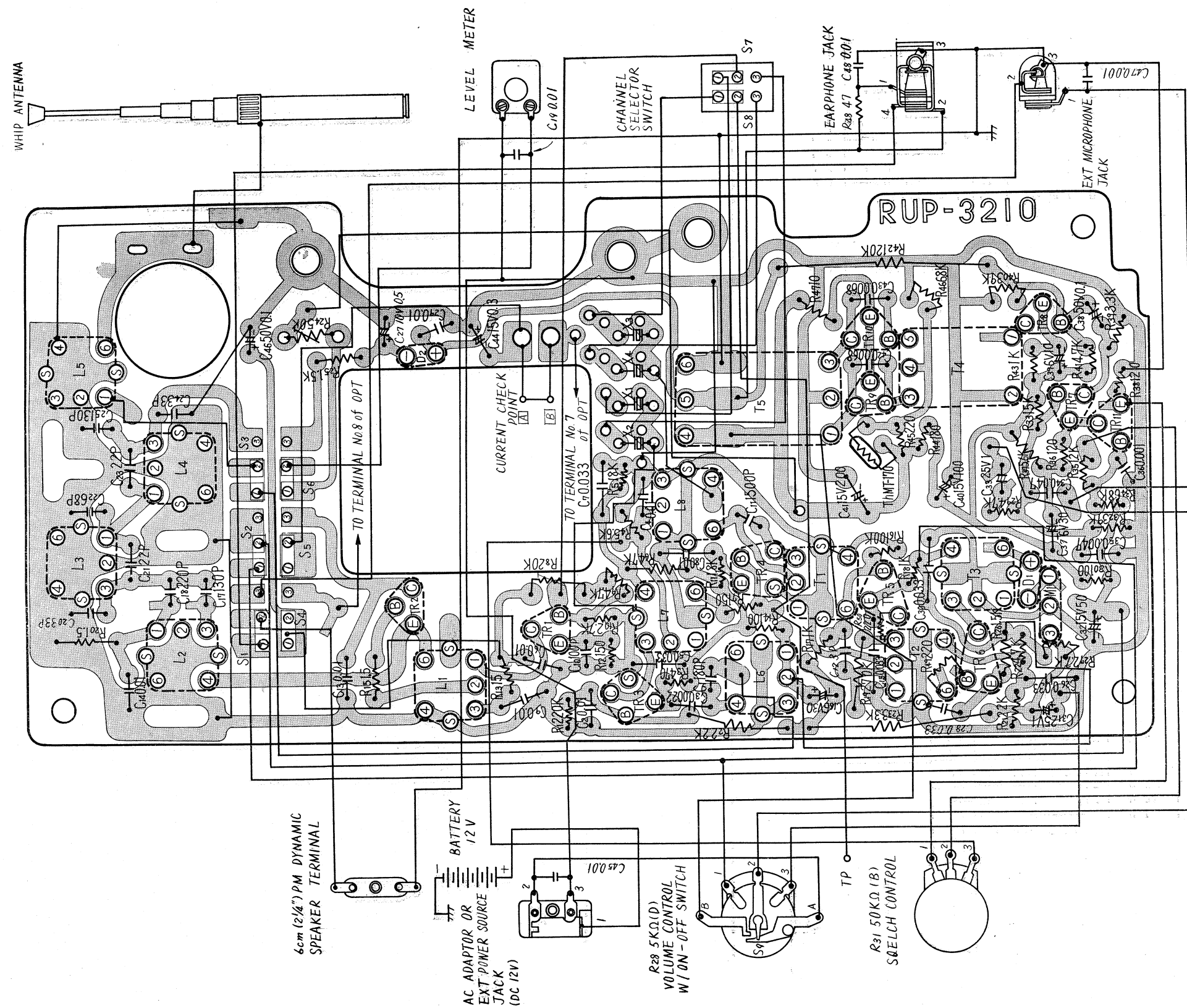
1. In all the above alignments, keep signal generator output low enough to maintain reading of 0.5 volts or less on VTVM to avoid AGC action.
2. Use only non-metallic alignment tools to insure proper alignment.
3. After alignment has been completed, all coil slugs that have been moved during alignment should be rewaxed to insure stability of operation with same type wax originally used.



Notes:

1. S1~S6: Push to talk switch in "RECEIVE" position.
2. S7, S8: Channel selector switch in "A" position.
3. S9: Power source switch in "OFF" position.
4. DC Voltage measurements are taken with circuit tester (10K $\Omega$ /Volt) from negative terminal of battery.
5. Capital letters (M, K, J, P, C, D) in the circuit diagram show allowable tolerances of resistors and capacitors as follows:  
M=±20% K=±10% J=±5% P=+100%  
C=±0.25PF D=±0.5PF
6. Battery Current:  
Receiver.....13mA (at no input signal)  
.....67mA (at maximum output)  
Transmitter .....130mA
7. PF=pico farad=mmf  
μF=micro farad=MF
8. All resistor values in ohms (K=1000 $\Omega$ ).
9. All capacitor values in micro farads (P=μF).

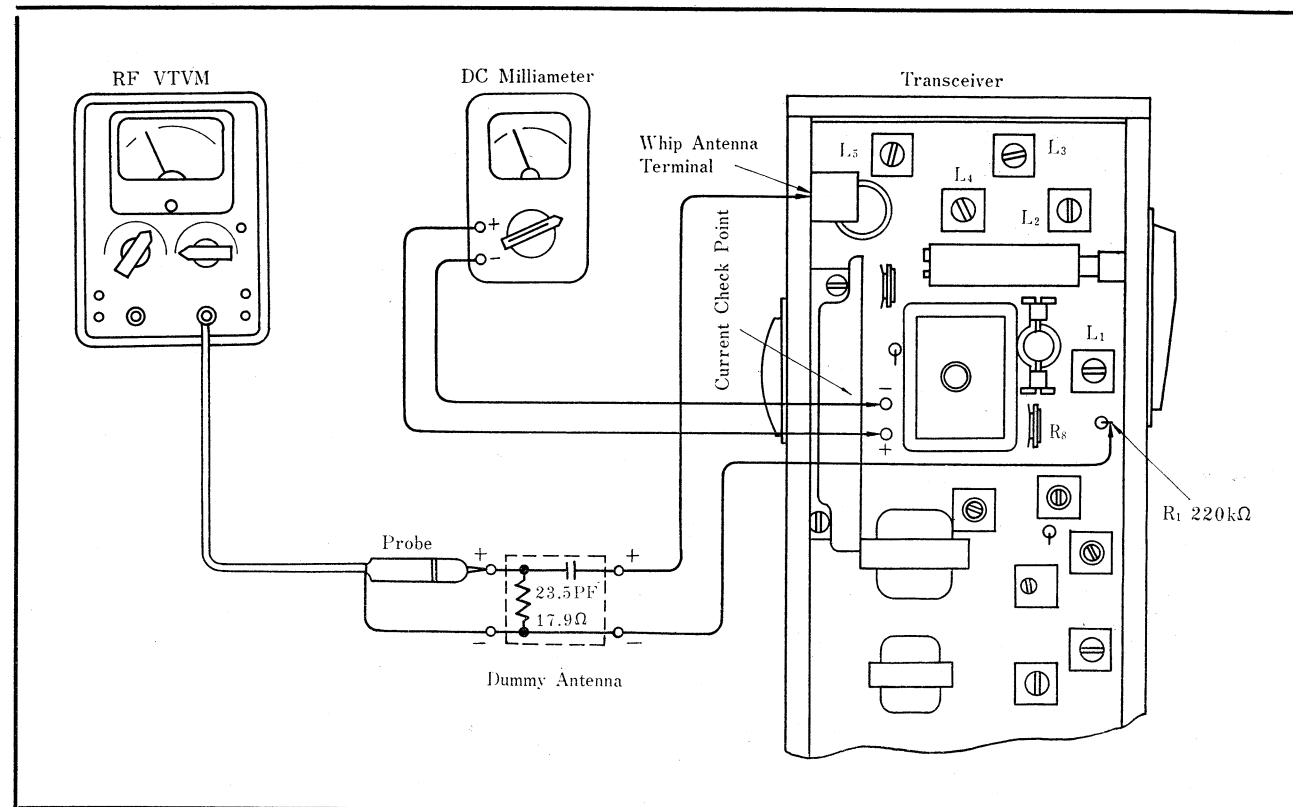
Fig. 6 Schematic Diagram.



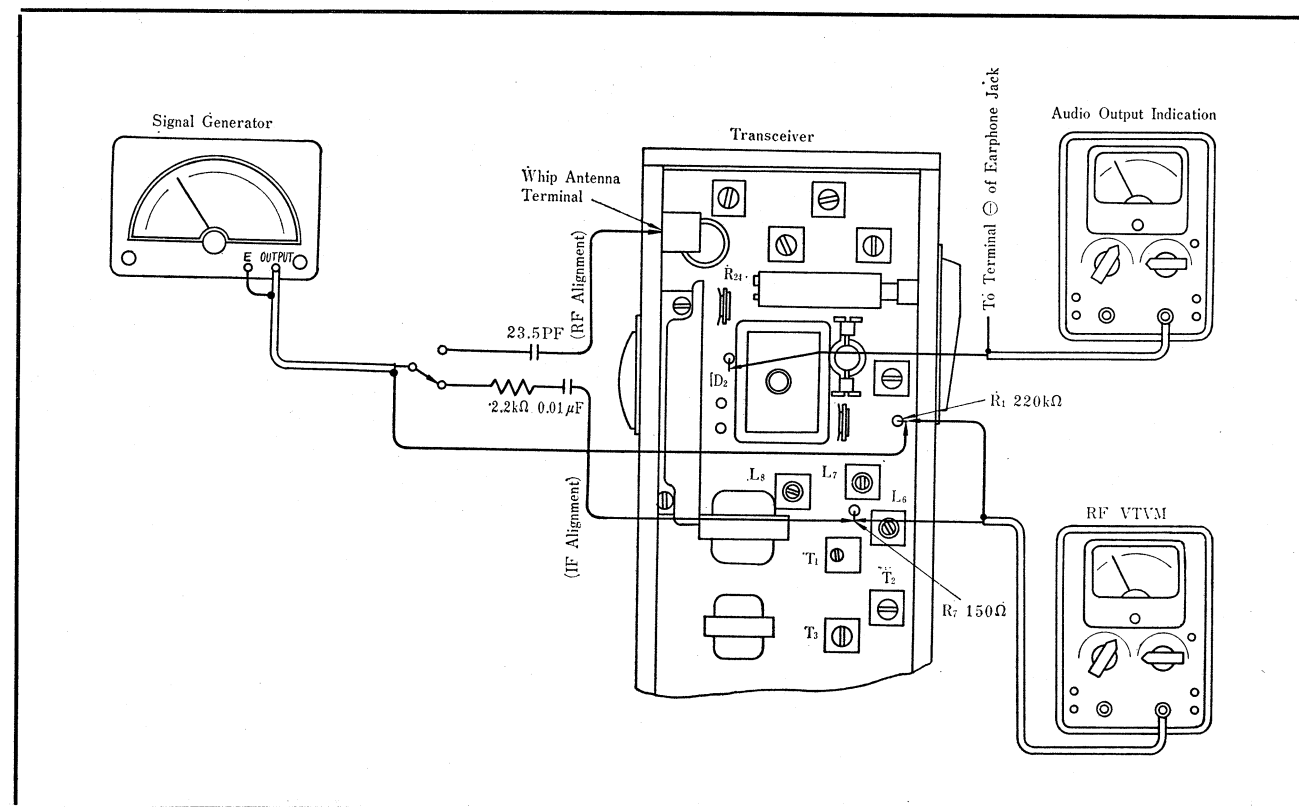
Notes :

1. All resistor values in ohms (K=1000 $\Omega$ ).
2. All capacitor values in micro farads (P= $\mu$ F).

Fig. 7 Circuit Board Wiring View (Conductor Side).



**Fig. 8 Test Equipment Set - Up for Transmitter Alignment.**



**Fig. 9 Test Equipment Set - Up for Receiver IF and RF Alignment.**

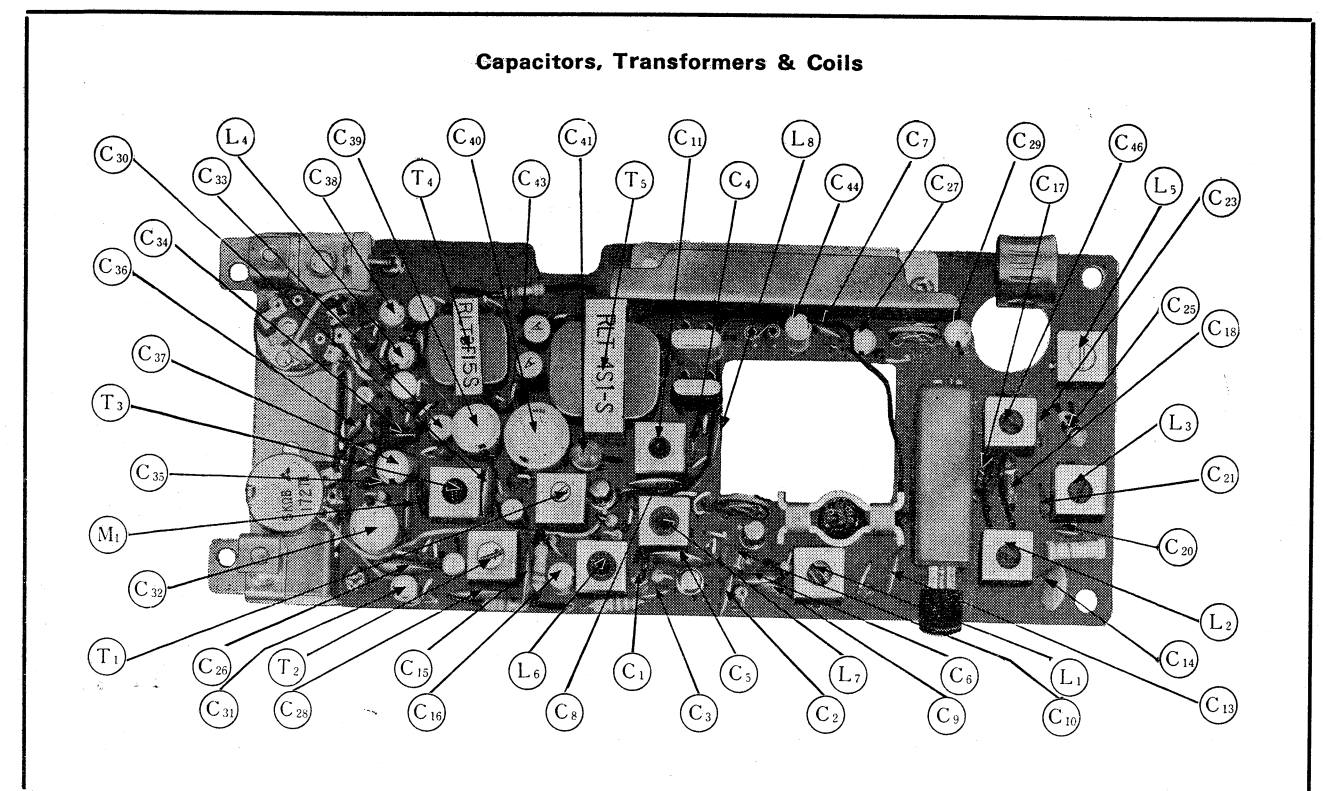
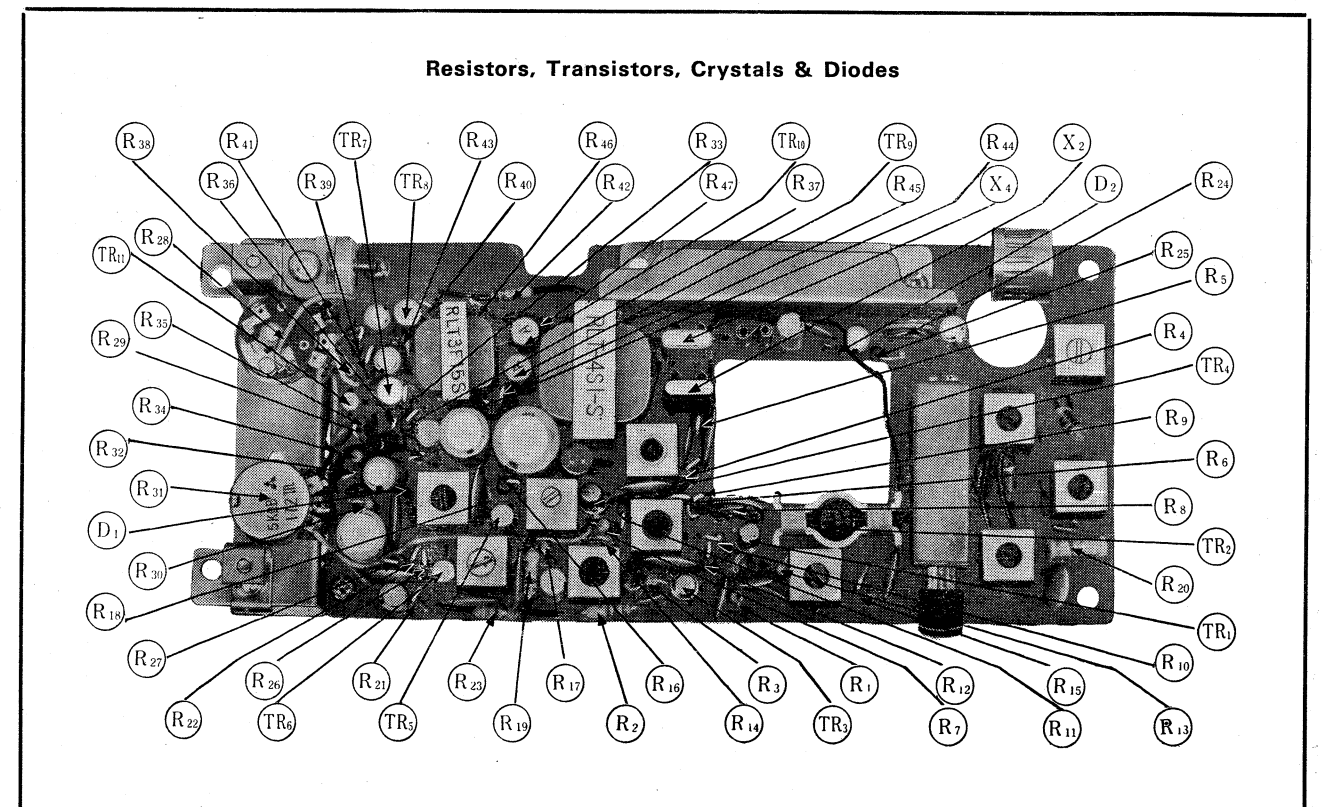


Fig. 10 Component View - Parts Identification.



**Fig. 11 Component View - Parts Identification.**

REPLACEMENT PARTS LIST
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Ref. No.	Part No.	Description
TRANSISTORS AND DIODES		
TR <sub>1</sub>	2SC478	Transmitter Oscillator
TR <sub>2</sub>	2SC456	Transmitter Last Stage Amplifier
TR <sub>3</sub>	2SA341	Receiver RF Amplifier
TR <sub>4</sub>	2SA341	Receiver Converter
TR <sub>5</sub>	2SA101	1st IF Amplifier
TR <sub>6</sub>	2SA101	2nd IF Amplifier
TR <sub>7</sub>	2SB173	1st AF Amplifier
TR <sub>8</sub>	2SB175	2nd AF Amplifier
TR <sub>9</sub>	2SB178	Power & Modulator Amplifier (push-pull)
TR <sub>10</sub>	2SB178	
TR <sub>11</sub>	2SC183	Receiver Squelch
D <sub>1</sub>	OA90	Detector & AGC
D <sub>2</sub>	OA90	AF Detector
CRYSTALS		
Freq. Group I :	Usable for following parts numbers :	
X <sub>1</sub>	26.965 (B <sub>1</sub> )→HC-25/U26.965 (B <sub>2</sub> ) or 26.965 (B <sub>3</sub> )	
X <sub>2</sub>	27.005 (B <sub>1</sub> )→HC-25/U27.005 (B <sub>2</sub> ) or 27.005 (B <sub>3</sub> )	
X <sub>3</sub>	HC-25/U 27.420 (B) Receiver	
X <sub>4</sub>	HC-25/U 27.460 (B) Receiver	
Freq. Group II :		
X <sub>1</sub>	27.055 (B <sub>1</sub> )→HC-25/U27.055 (B <sub>2</sub> ) or 27.055 (B <sub>3</sub> )	
X <sub>2</sub>	27.085 (B <sub>1</sub> )→HC-25/U27.085 (B <sub>2</sub> ) or 27.085 (B <sub>3</sub> )	
X <sub>3</sub>	HC-25/U 27.510 (B) Receiver	
X <sub>4</sub>	HC-25/U 27.540 (B) Receiver	
Freq. Group III :		
X <sub>1</sub>	27.155 (B <sub>1</sub> )→HC-25/U27.155 (B <sub>2</sub> ) or 27.155 (B <sub>3</sub> )	
X <sub>2</sub>	27.185 (B <sub>1</sub> )→HC-25/U27.185 (B <sub>2</sub> ) or 27.185 (B <sub>3</sub> )	
X <sub>3</sub>	HC-25/U 27.610 (B) Receiver	
X <sub>4</sub>	HC-25/U 27.640 (B) Receiver	
Freq. Group III :		
X <sub>1</sub>	27.255 (B <sub>1</sub> )→HC-25/U27.225 (B <sub>2</sub> ) or 27.225 (B <sub>3</sub> )	
X <sub>2</sub>	27.275 (B <sub>1</sub> )→HC-25/U27.275 (B <sub>2</sub> ) or 27.275 (B <sub>3</sub> )	
X <sub>3</sub>	HC-25/U 27.680 (B) Receiver	
X <sub>4</sub>	HC-25/U 27.730 (B) Receiver	
THERMISTOR		
Th	MT-170	Temperature Compensator
CAPACITORS		
C <sub>36</sub> , C <sub>47</sub>	ECK-D05102P	0.001mfd, 50WV, +100%, Ceramic - 0%, Disc
C <sub>3</sub>	ECK-D05222MY	0.0022mfd, 50WV, ±20%, Ceramic Disc
C <sub>2</sub> , C <sub>4</sub> , C <sub>6</sub> , C <sub>9</sub> , C <sub>13</sub>	ECK-D05103P	0.01mfd, 50WV, +100%, Ceramic - 0%, Disc
C <sub>14</sub> , C <sub>19</sub> , C <sub>29</sub> , C <sub>45</sub> , C <sub>48</sub>	ECK-D05103MY	0.01mfd, 50WV, ±20%, Ceramic Disc
C <sub>8</sub>	ECK-D05333P	0.033mfd, 50WV, +100%, Ceramic - 0%, Disc
C <sub>5</sub> , C <sub>7</sub> , C <sub>15</sub>	ECC-D05030C	3mmf, ±0.25mmf, Ceramic
C <sub>26</sub> , C <sub>28</sub> , C <sub>30</sub>	ECC-D05220J	22mmf, ±5%, Ceramic
C <sub>12</sub>	ECC-D05330J	33mmf, ±5%, Ceramic
C <sub>21</sub> , C <sub>23</sub>	ECC-D05680J	68mmf, ±5%, Ceramic
C <sub>20</sub> , C <sub>24</sub>	ECQ-S1101KZ	100mmf, ±10%, Styrol
C <sub>22</sub>	ECQ-S1131JZ	130mmf, ±5%, Styrol
C <sub>10</sub>	ECQ-S1181KZ	180mmf, ±10%, Styrol
C <sub>17</sub> , C <sub>25</sub>	ECQ-S1221KZ	220mmf, ±10%, Styrol
C <sub>1</sub>	ECQ-S1152KZ	1500mmf, ±10%, Styrol
C <sub>18</sub>	ECQ-G05472MZ-N	0.0047mfd, 50WV, ±20%, Polyester
C <sub>11</sub>	ECQ-G05682MZ-N	0.0068mfd, 50WV, ±20%, Polyester
C <sub>35</sub>		
C <sub>42</sub> , C <sub>43</sub>		



**MODEL RJ-20E**

Ref. No.	Part No.	Description
CAPACITORS		
C34	ECQ-G05473MZ-N	0.047mfd, 50WV, $\pm 20\%$ , Polyester
C38, C46	ECE-A50V0.1M	0.1mfd, 50WV, Electrolytic
C44	ECE-A15V0.3M	0.3mfd, 15WV, Electrolytic
C27	ECE-A10V0.5M	0.5mfd, 10WV, Electrolytic
C31, C33	ECE-A25V1	1mfd, 25WV, Electrolytic
C39	ECE-A6V10	10mfd, 6 WV, Electrolytic
C16, C37	ECE-A6V30	30mfd, 6 WV, Electrolytic
C32	ECE-A15V50	50mfd, 15WV, Electrolytic
C40	ECE-A15V100	100mfd, 15WV, Electrolytic
C41	ECE-A15V200	200mfd, 15WV, Electrolytic
RESISTORS		
R48	ERD-14TK 470	47 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R7	ERD-14TK 151	150 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R2	ERD-14TK 222	2.2K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R23	ERD-14TK 332	3.3K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R42	ERD-14TK 124	120K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R1	ERD-14TK 224	220K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R19	ERD-14TK 274	270K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R49, R50	ERD-14TK 221	220 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R15	ERD-14VK 1R5	1.5 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R47	ERD-14VK 100	10 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R13	ERD-14VK 150	15 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R14, R30	ERD-14VK 101	100 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R36, R38	ERD-14VK 121	120 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R12	ERD-14VK 151	150 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R44	ERD-14VK 181	180 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R45	ERD-14VK 221	220 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R3	ERD-14VK 471	470 $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R17, R18, R43	ERD-14VK 102	1K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R35	ERD-14VK 122	1.2K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R25, R26	ERD-14VK 152	1.5K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R11	ERD-14VK 182	1.8K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R10, R27	ERD-14VK 272	2.7K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R39	ERD-14VK 332	3.3K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R6, R9, R22, R29, R41	ERD-14VK 472	4.7K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R4, R37	ERD-14VK 562	5.6K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R33	ERD-14VK 153	15K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R5	ERD-14VK 183	18K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R21	ERD-14VK 223	22K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R32, R40	ERD-14VK 393	39K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R34	ERD-14VK 683	68K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R16	ERD-14VK 104	100K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R46	ERD-14VK 682	6.8K $\Omega$ , $\frac{1}{4}$ Watt, $\pm 10\%$ , Carbon
R20	ERW-12L1R5	1.5 $\Omega$ , $\frac{1}{2}$ Watt, $\pm 10\%$ , Wire
R24	EVL-TOAA00B54	50K $\Omega$ (B), Level Meter Control
R8	EVL-TOAA00B24	20K $\Omega$ (B), Current Adjustment
R28	EVH-BOBL20D53	5K $\Omega$ (D), Volume Control W/ON-OFF Switch (S9)
R31	EVH-BOAL20B53	5K $\Omega$ (B), Squelch Control
COMPONENT COMBINATION		
M1	EXA-3HLO1471	0.01mfd, 0.01mfd & 470 $\Omega$
COILS AND TRANSFORMERS		
L1	RLO-7C6-T	Transmitter Oscillator Coil
L2	RLA-7C5-T	Transmitter Last Stage Coil
L3	RLA-7C6-T	Low Pass Filter Coil
L4	RLA-7C6-T	Low Pass Filter Coil
L5	RLA-7C7-T	Loading Coil
L6	RLA-7C2-T	Receiver Antenna Coil
L7	RLD-7C6-T	Receiver RF Coil
L8	RLO-7C4-T	Receiver Oscillator Coil
T1	RLI-7C12	Ceramic Filter
T2	RLI-2C250-T	2nd IF Transformer
T3	RLI-2C451-T	3rd IF Transformer
T4	RLT-3F15(S)	Input Transformer, P=5K $\Omega$ : S=2.5K $\Omega$
T5	RLT-4S1(S)	Output Transformer, P=750 $\Omega$ : S=8 $\Omega$
SPEAKER AND EARPHONE		
SP	EAS-6P81S	6 cm (2 $\frac{1}{4}$ ") PM Dynamic Speaker, 8 $\Omega$
EP	EAE-1RB	Magnetic Earphone, 8 $\Omega$



**MODEL RJ-20E**

Ref. No.	Part No.	Description
SWITCHES		
S1~S6 S7~S8	RSH-5-1 RSS-14	Push To Talk Switch Channel Selector Switch
MISCELLANEOUS		
	RJP-44 RJJ-13-1 RJJ-47-1 RJJ-51-1 RJS-20 RJA-23-2 RJT-709-1 RJT-717 RJE-3-1 RUD-87 RUV-169 RUS-47-1 RMM-24 RMS-11 RMX-145-1 RMY-49 RBE-21 RBX-33 DM3-6R ⊕B2-8N ⊕B3-6N ⊕B3-8N ⊕B3-8R RNT-302	Plug, Current Check Point (2 Req'd) Jack, Earphone Jack, EXT Power Source Jack, Microphone Socket, Crystal (8 Req'd) Cord, EXT Power Source Shorting Ring, Current Check Point Terminal, Whip Antenna Adaptor, Battery Spacer, Cabinet Back Cover Cover, EXT Power Source Jack Spring, Push To Talk Bracket, Level Meter Bracket, Speaker (2 Req'd) Bracket, Whip Antenna (Plastic) Heat Sink, Transistor (TR <sub>9</sub> & TR <sub>10</sub> ) Spring, Knob (RBB-9) Screw, Cabinet Back Cover M'tg. Red Screw, Chassis M'tg. (5 Req'd) Screw, EXT Power Source Jack M'tg. (4 Req'd) Screw, Cabinet Back Cover (2 Req'd) Screw, Cabinet Back Cover Red Screw, Whip Antenna Washer, Cabinet Back Cover (2 Req'd)
APPEARANCE		
	RYA-2780 RKM-1232 RKF-980 RKK-59-1 RGC-650 RGB-5 RGB-199 RGT-1030 RMK-91 RGX-273 RGX-277 RGX-280 RGX-282 RGK-169 RGK-240 RGK-262 RBN-46-2 RBB-9 RBC-24 RBC-29 RJK-3001 RJK-3002 RANT160-11-1 V-203	Cabinet Complete Cabinet Only Cover Only, Cabinet Back Cover Only, Cabinet Upper Side Escutcheon Badge, National Mark Badge, NATIONAL PANASONIC Mark Name Plate Ornament, Earphone & Microphone Jack Ornament, Push To Talk Switch Ornament, Level Meter Ornament, Button Ornament, Channel Selector Switch Indicating Plate, SQUELCH & VOLUME Mark Indicating Plate, Channel Selector Switch Mark Indicating Plate, Battery Case Knob, Squelch & Volume Knob, Channel Selector Switch Button, Battery Case Button, Push To Talk Switch Case, Battery Cover, Battery Case Whip Antenna, 145 cm Level Meter